

Redefinition of the genus *Notoplax* H. Adams, 1861, and recognition of the monotypic New Zealand genus *Pseudotonicia* Ashby, 1928 (Mollusca: Polyplacophora: Acanthochitonidae).

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ABSTRACT

The genus *Notoplax* is redefined, and the monotypic genus *Pseudotonicia*, endemic to New Zealand, which was previously considered a synonym of *Notoplax*, is recognised as a distinct genus and defined. The sole member of this genus, *P. cuneata*, is reviewed and redescribed, and its habitat given. Similarities between *Pseudotonicia* and the Australian genus *Bassethullia* are discussed.

INTRODUCTION

Notoplax was erected by H. Adams (1861) as a subgenus of *Cryptoplax* Blainville, 1818 and its status has varied from a full genus (e.g. Dall, 1882; Iredale and Hull, 1925, 1927) to a synonym of *Craspedochiton* Shuttleworth, 1853 (Smith, 1960). The genus *Pseudotonicia* was erected by Ashby (1928) to contain the single species *Tonicia cuneata* Suter, 1908. *Pseudotonicia* was given full generic rank by Ashby (1928) and Bucknill (1928), but was synonymised with *Notoplax* by Iredale & Hull (1931), an action followed by Powell (1937, 1957) and Dell (1951). Smith's (1960) classification of the Acanthochitonidae synonymised all genera with five or more slits in the posterior valve insertion plate under *Craspedochiton*, except *Cryptoconchus* Burrow, 1815 and *Cryptochiton* Middendorff, 1847, which he recognised as distinct genera. Van Belle (1978) separated *Notoplax* from *Craspedochiton*, and placed the other groups previously synonymised by Smith (1960) with *Craspedochiton*, under either *Notoplax* or *Craspedochiton*, the main criteria for separation being the length of the posterior valve insertion plate and teeth: long in *Notoplax* and short in *Craspedochiton*, with *Pseudotonicia* being included under *Notoplax*. This classification was followed by Powell (1979), Kaas and Van Belle (1980) and Van Belle (1983). *Bassethullia* Pilsbry, 1928, regarded by Van Belle (1978, 1983) and Kaas and Van Belle (1980) as a subgenus of *Notoplax*, was separated by Gowlett-Holmes (1990) as a distinct genus. *Notoplax* and *Craspedochiton* (*sensu* Van Belle, 1983) contain many species, mainly poorly known, from the temperate and tropical Pacific, Indian and Southern Oceans, and the Red Sea area (Kaas and Van Belle, 1980).

Here, the genus *Notoplax* is redefined and restricted, based on examinations of its members. The genus *Pseudotonicia* is re-evaluated and defined as a distinct

genus, based on a detailed examination of its sole member, *P. cuneata*, which is endemic to New Zealand. The similarities, both in appearance and habitat, between *P. cuneata* and the members of the endemic southern Australian genus *Bassethullia* Pilsbry, 1928 are discussed.

MATERIALS AND METHODS

All available material from the Australian Museum, Sydney (AM), Museum of Victoria, Melbourne (MV), Queensland Museum, Brisbane (QM), South Australian Museum, Adelaide (SAM), Tasmanian Museum and Art Gallery, Hobart (TM), Western Australian Museum, Perth (WAM), the National Museum of New Zealand, Wellington (NMNZ), the New Zealand Geological Survey, Lower Hutt (NZGS), the Auckland Institute and Museum (AIM), and type material from the Academy of Natural Sciences of Philadelphia (ANSP) and the British Museum (Natural History), London (BMNH) has been examined. Radulae were prepared for examination under the scanning electron microscope (SEM) after the method of Bandel (1984). The species description of *P. cuneata* is based on the type and other available material. Colour descriptions follow Kornerup and Wanscher (1978).

FAMILY ACANTHOCHITONIDAE PILSBRY, 1893

Genus *Notoplax* H. ADAMS, 1861

Notoplax H. Adams, 1861, p. 385. Type-species: *Cryptoplax (Notoplax) speciosa* H. Adams, 1861, by monotypy.

Macandrellus (Carpenter MS) Dall, 1879, p. 299. Type-species: *Acanthochites costatus* H. Adams & Angus, 1864, by original designation.

Eoplax Ashby & Cotton, 1936, p. 520. Type-species: *Acanthochiton (Eoplax) adelaidae* Ashby & Cotton, 1936, by original designation.

Diagnosis

Medium to large chitons (Figs 1,2); tegmentum reduced; jugum well defined, narrow, smooth; lateral and pleural areas with similar sculpture of pustules of different forms; articulamentum large; insertion plates large on all valves, with relatively short slits; slits 5/1/3-10 without sinus; girdle large, thick, very fleshy, densely spiculate, completely (rarely almost completely) encroaching between valves, sutural tufts always present, but usually not prominent; gills merobranchial.

Remarks

This taxon is given full generic rank here, and restricted in definition from the broad sense it was used in by Van Belle (1978, 1983) and Kaas and Van Belle (1980). Van Belle (1983) recognised three subgenera within *Notoplax*; *Bassethullia*, which was shown to be a distinct genus by Gowlett-Holmes (1990); *Spongiochiton* Dall, 1882, which examination of the type species has shown to be a synonym of *Craspedochiton*; and the nominate subgenus *Notoplax*, under which a number of other groups were synonymised. After examination of the type species of these groups, as well as Australian and New Zealand species which would be classified in *Notoplax sensu* Van Belle (1983), it became apparent that this classification was an artificial lumping of several distinct groups that should be recognised as separate. The exact status of some of these groups must await more detailed examination of

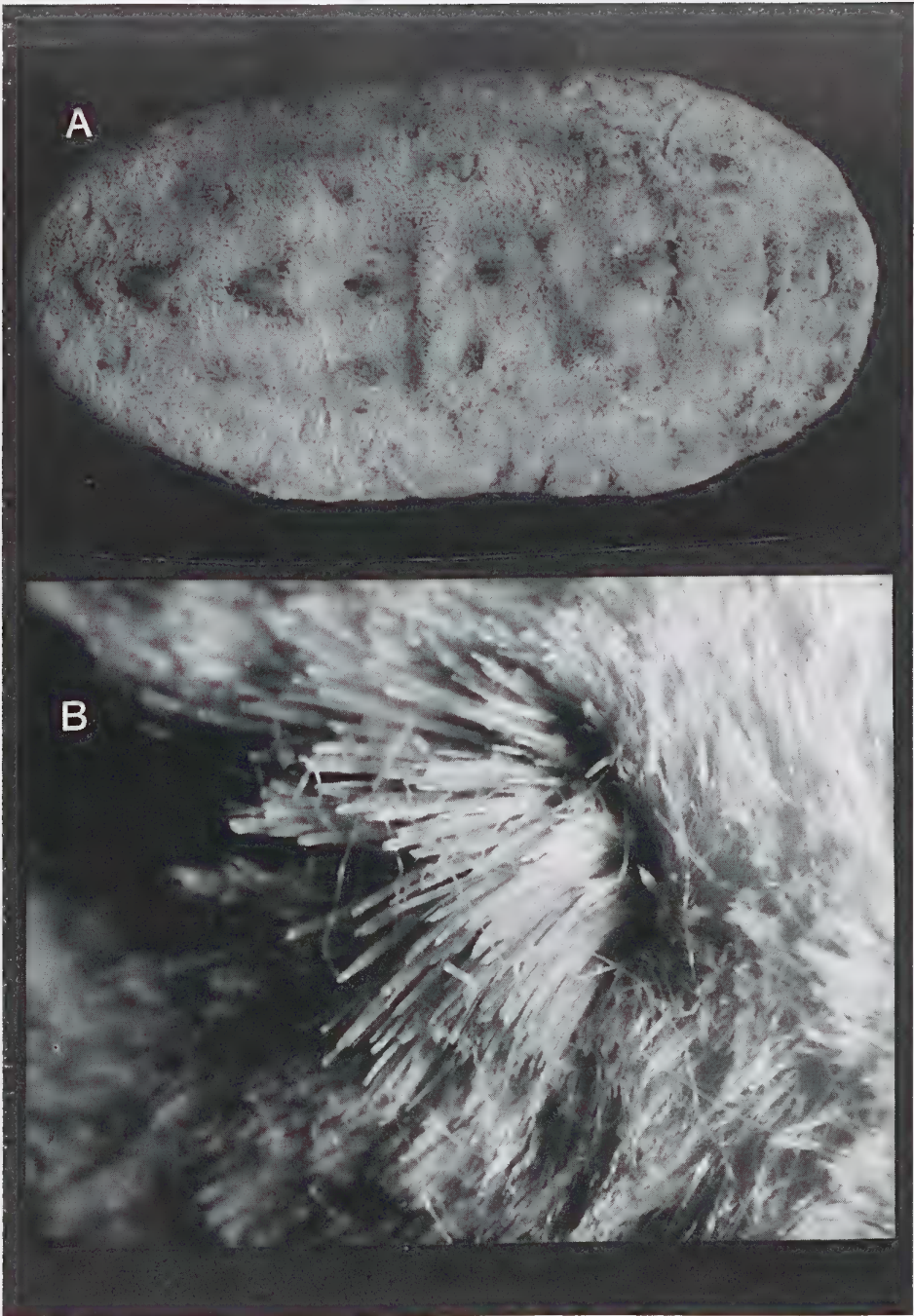


Figure 1. *Notoplax speciosa* (MV F52815). A. whole specimen, x 2; B. detail of girdle showing sutural tuft, x 27.

species unavailable to the present study. However, *Notoplax* s.s., as defined above, can be consistently distinguished from the other groups by its very large insertion plates with short slits on all valves, the smooth, well defined, narrow jugum, and the very large, thick, fleshy, spiculose girdle which is usually completely encroaching between the valves. I believe these characters are significant at the generic level, and warrant the recognition of *Notoplax* s.s. as defined, as a distinct genus in the family Acanthochitonidae.

Macandrellus Dall, 1879 is retained as a synonym of *Notoplax* s.s., as the characters of the type species, *Acanthochites costatus* H. Adams & Angas, 1864, are all within the range of characters of *Notoplax* s.s. as defined above.

Eoplax Ashby & Cotton, 1936 is included here as a synonym of *Notoplax* s.s. *Eoplax* was erected by Ashby and Cotton (1936) as a subgenus of *Acanthochiton*. Cotton and Godfrey (1940) elevated *Eoplax* to full generic rank, which was followed by Cotton and Weeding (1941) and Cotton (1964). Cotton and Weeding (1941) regarded *Eoplax* as "the fossil equivalent to the living *Notoplax* s.s.". Van Belle (1983) synonymised *Eoplax* with *Acanthochitona*, but after examining the holotype (SAM P10159) and only known specimen of the type species, *Acanthochiton (Eoplax) adelaidae* Ashby & Cotton, 1936, which is in an excellent state of preservation, I believe this species belongs in *Notoplax* because of its reduced tegmentum, smooth, narrow jugum, the pustulose sculpture of the lateropleural areas, and very large insertion plates, and that *Eoplax* is a junior synonym of *Notoplax* s.s.

An examination of species previously placed in *Notoplax* s.l. by Kaas and Van Belle (1980), revealed that only species from Australia and New Zealand could be included in *Notoplax* s.s., and this genus appears to be restricted to this region.

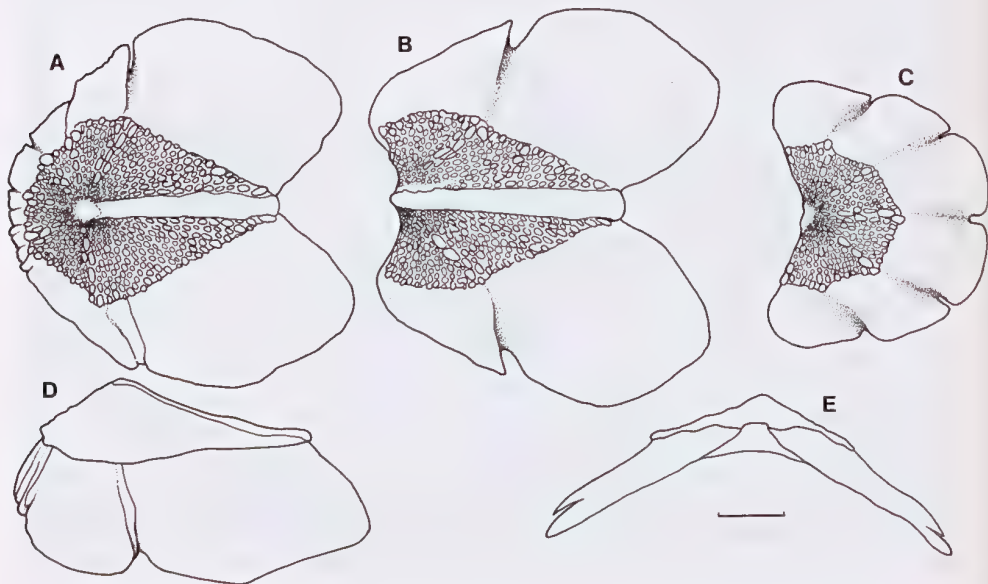


Figure 2. *Notoplax speciosa* (MV F52814). A. posterior valve; B. median valve; C. anterior valve; D. posterior valve (lateral profile); E. median valve (posterior profile); scale bar = 2 mm.

Genus *Pseudotonicia* Ashby, 1928

Pseudotonicia Ashby, 1928, p. 392. Type-species: *Tonicia cuneata* Suter, 1908, by original designation.

Diagnosis

Medium chitons; tegmentum somewhat reduced; jugum smooth, poorly differentiated; lateral and pleural areas sculpture of grooves and triangular pits; insertion plates large, slits 1/7-1/3 width of insertion plates; slit formula 4-5/1/7-10 without sinus; girdle large, microscopically spiculose; partially encroaching between valves; sutural tufts present, but very small and inconspicuous; gills merobranchial.

Remarks

This group is given full generic rank here. *Pseudotonicia* differs consistently from *Notoplax* s.s. as defined above, in several important characteristics. In *Pseudotonicia*, the sculpture of the lateral and pleural areas, when present, is of grooves and triangular pits, whereas in *Notoplax*, these areas are strongly sculptured with pustules. Also, the jugum is poorly defined in *Pseudotonicia*, as compared with *Notoplax*. The girdle in *Pseudotonicia*, although large, is not as thick as in *Notoplax*, it is also much more finely spiculose, and only partially encroaches between the valves. I believe these characters are significant at the generic level and warrant the recognition of *Pseudotonicia* as a full genus in the family Acanthochitonidae.

Pseudotonicia superficially resembles *Bassethullia*, but can be easily distinguished by the form of the sculpture of the lateral and pleural areas, which is grooves and triangular pits in the former, and ridges and grooves, often with pustules, in the latter. The girdle in *Pseudotonicia* is also much larger than that in *Bassethullia*. These two genera are the only ones recorded for the Acanthochitonidae in which the sculpture of the lateral and pleural areas includes grooves.

Pseudotonicia cuneata (Suter, 1908)

Figs 3-7.

Tonicia cuneata Suter, 1908, p. 360, pl. 28, figs 1, 2; Ashby, 1926, p. 31.

Notoplax cuneata (Suter): Suter, 1913, p. 42, pl. 5, fig. 1; Powell, 1937, p. 93; Dell, 1951, p. 8; Powell, 1957, p. 124; Beu, 1967, p. 479; Powell, 1979, p. 30, pl. 5, fig. 10; Kaas & Van Belle, 1980, p. 35.

Craspedochiton cuneatus (Suter): Iredale, 1914, p. 130; Iredale, 1915, p. 422, 425.

Pseudotonicia cuneata (Suter): Ashby, 1928, p. 393; Bucknill, 1928, p. 627; Ashby, 1929, p. 377.

Acanthochitona (*Notoplax*) *cuneata* (Suter): Beu, 1977, p. 48, 51.

Material examined

Type: Lectotype (NZGS TM1234) from Bay of Islands, North Island, New Zealand, collected by J.C. Anderson (selected by Boreham, 1959, p. 73, see remarks below).

Other material: North Island: BS871, 34°49.6'S; 173°15.0'E, off Rangaunu Bay, 23 m (1, SAM D18608); Matai Bay, Karikari Peninsula, 8-10 m (13, SAM D18607); BS221, Bay of Islands, 6-8 m (1, NMNZ M.95116); BS448, 35°13.9'S; 174°15.5'E, Rawhiti Channel, Bay of Islands, 3-5 m (1, NMNZ M.95158); Leigh,

Whangateau Harbour (7, NMNZ M.8784-5, M.95180); Mount Maunganui, Tauranga Harbour (83, SAM D11050, D11110, D18604-5, D18609, D18628-30; 2, AM C156953; 9, NMNZ M.1588, M.3611, M.70249, M.92445, M.95087, M.95176; 7, AIM); BS738, 37°40.3'S; 176°22.7'E, off Motiti Island, 20 m (1, NMNZ M.95133); Lottin Point, 3-8 m, (2, SAM D18606); BS770, 37°33.4'S; 178°48.3'E, Ranfurly Bank, East Cape, 106-103 m (1, NMNZ M.95137); BS679, 37°35.6-8'S; 178°52.3-7'E, Ranfurly Bank, East Cape, 49 m (2, NMNZ M.65468); BS923, 37°37.8'S; 178°52.4'E, Ranfurly Bank, East Cape, 50-72 m (1, NMNZ M.95187); Days Bay, Wellington (1, NMNZ M.95072); Plimmerton (1, NMNZ M.95066); Onepoto Point, Kapiti Island (1, NMNZ M.95081); BS490, 39°57'S; 174°34'E, off Waitotara River mouth, 33-35 m (2, NMNZ M.50478, M.95140); Stephens Island, Cook Strait (1, NMNZ M.3612). South Island: Tahuna Beach, Nelson (8, NMNZ M.5376, M.94918); Separation Point, Nelson (1, NMNZ M.36950).

Species description

Medium to large chiton to 60 mm (Fig. 4A). Carinated, low elevation (Fig. 7D); tegmentum about 45-50% of articulamentum. Tegmentum with numerous random aesthetes (Fig. 6A). Tegmentum colour very variable, base colour of pale yellowish white to greyish yellow to greyish rose to pink, with speckles, stripes and streaks of reddish brown, brown, olive brown, dark green or black, occasionally with large blotches of reddish brown (Fig. 5). Articulamentum white to pinkish white to pale greyish green, with greyish rose to dull green under the tegmentum. Slit formula 4-5/1/7-10. Girdle colour very variable, base colour of pale yellowish white to greyish yellow-orange to greyish rose-ruby to yellowish brown to light to medium grey to olive grey to olive brown to reddish brown, usually blotched, streaked and speckled with these colours plus brown, dark green and black. Sutural tufts microscopic, white.



Figure 3. *Pseudotonicia cuneata* (SAM D18604). Individual free-living in sand, covering sand removed, 1 m water depth, Mount Maunganui, North Island, New Zealand, Sept. 1988.

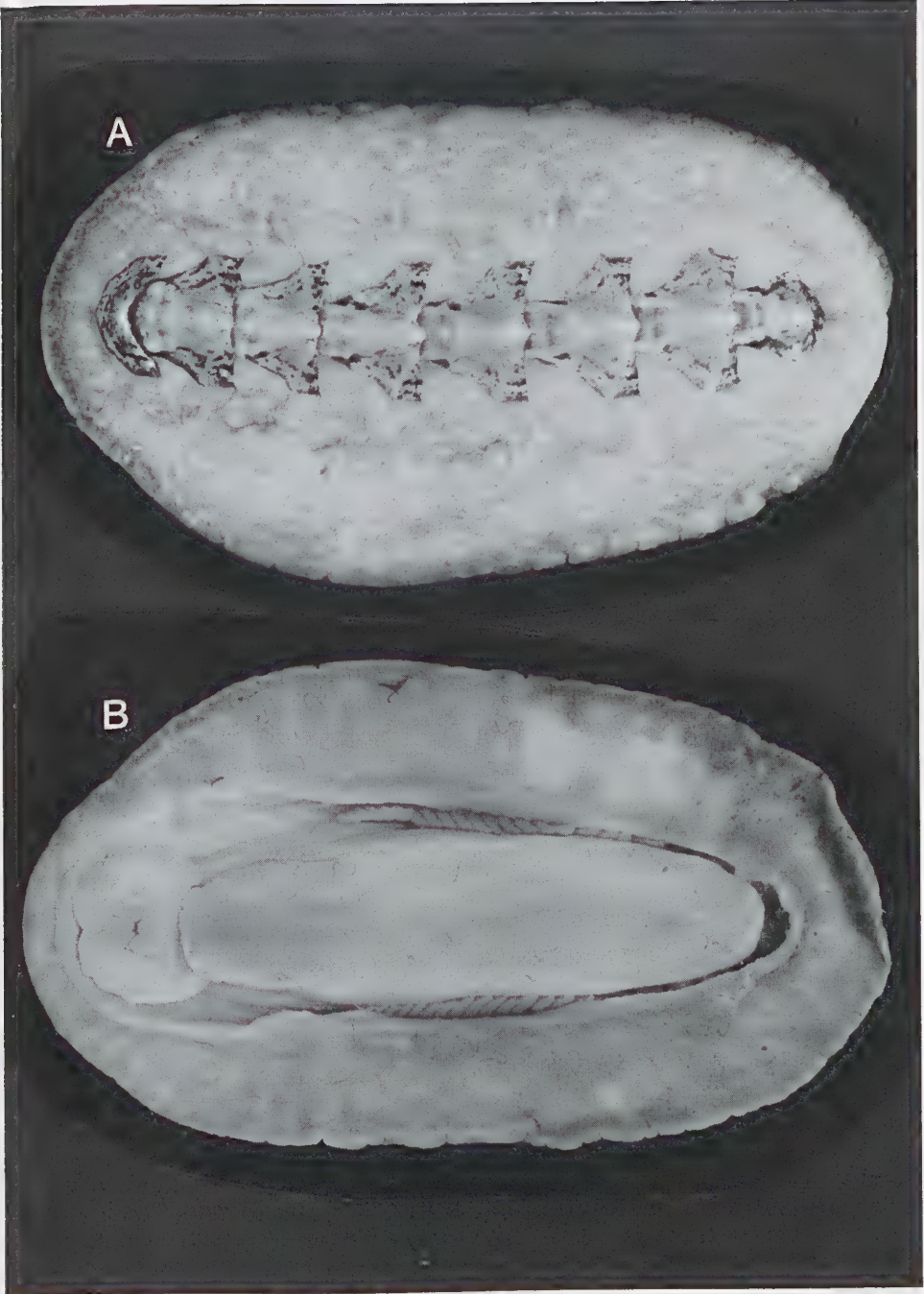


Figure 4. *Pseudotonicia cuneata* (SAM D18604). A. dorsal view, x 3; B. ventral view, x 3.



Figure 5. *Pseudotonicia cuneata* (SAM D18604). Range showing variation in pattern, x 0.9 (note: lines and textures on girdles are preservation artifacts).

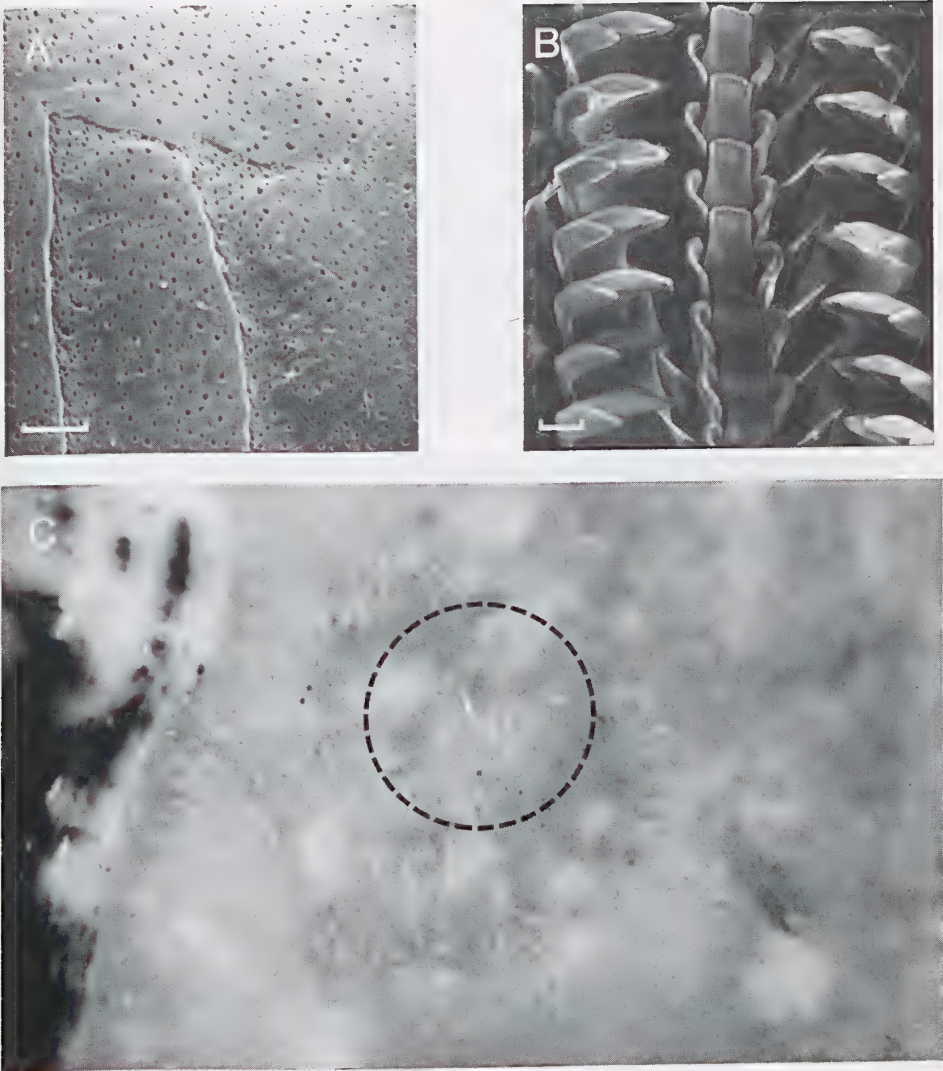


Figure 6. *Pseudotonicia cuneata* (SAM D18604). A. detail of tegmentum surface showing aesthetes, scale bar = 100 μ m; B. radula, scale bar = 10 μ m; detail of girdle showing sutural tuft (circled), x 28.

Anterior valve (Fig. 7A) smooth except for slight irregular growth lines, sometimes with small, random, triangular pits; 5 very weak radial ribs. Slits 4-5, usually 5, 1/5-1/3 width of insertion plate, in shallow groove to edge of tegmentum. Median valves (Fig. 7B) beaked, posterior edge concave. Jugum smooth, triangular in shape, usually poorly defined, about 1/2 width of tegmentum; toothed near beak, teeth in form of longitudinal grooves. Lateral and pleural areas only sometimes differentiated by a very weak diagonal rib; smooth, usually with few, random, triangular pits, sometimes the pits coalescing to form longitudinal

grooves that are zigzag on one side, occasionally with extensive sculpture of triangular pits and pustules. Slit 1, $1/7-1/3$ width of insertion plate, in deep, often narrow groove $1/2-3/4$ way to edge of tegmentum, sometimes infilled with ridge rest of way. Posterior valve (Figs 7C, 7E) with tegmentum longer than wide; jugum and antimucronal areas like median valves; mucro smooth, in posterior $1/5$ of tegmentum; postmucronal slope steep, concave, often sculptured with many triangular pits and pustules. Slits 7-10, irregular, $1/5-1/3$ width of insertion plate, in deep grooves usually to edge of tegmentum, insertion plate often deeply incised in area of slit grooves.

Girdle (Fig. 4A) broad but not overly fleshy, densely spiculose with numerous microscopic ($40-55 \mu\text{m}$ long), coloured, straight to very slightly curved spicules, broad at base ($10 \mu\text{m}$ wide) and tapering to sharp point. Sutural tufts (Fig. 6C) very small, consisting of a few, much longer, clear, very slightly curved, sharp-tipped spicules ($190-250 \mu\text{m}$ long, $15 \mu\text{m}$ wide).

Gills (Fig. 4B) merobranchial, abanal, 20-25 ctenidia on each side, tapering large to small anteriorly.

Radula (Fig. 6B) with elongate, rectangular, slightly concave central teeth, apical edge of head slightly irregular; first lateral teeth narrow basally, with broad, rounded heads folded around base of central teeth; major lateral teeth elongate, narrow basally, with wide, tricuspidate heads, central cusp longest.

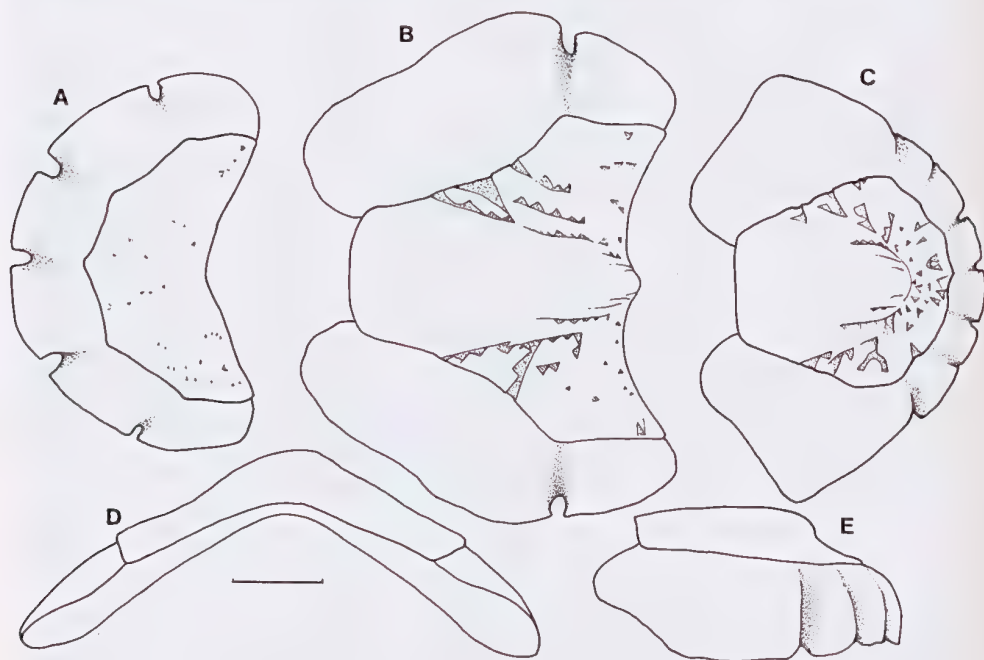


Figure 7. *Pseudotonicia cuneata* (SAM D18630). A. anterior valve; B. median valve; C. posterior valve; D. median valve (posterior profile); E. posterior valve (lateral profile); scale bar = 2 mm.

Habitat

On rock, cobbles, pebbles, shells and fragments in fine to medium, often silty and poorly sorted, sands; rarely free-living in silty, poorly sorted sands; in sandy areas

and pockets on reefs in low to medium energy areas (Fig. 3). Intertidal to at least 106 m depth.

Distribution

New Zealand, all of North Island coast and adjacent waters, to north coast of South Island, not recorded from the Three Kings Islands.

Remarks

This species was considered very rare (Suter, 1908, 1913; Iredale, 1915; Ashby, 1926, 1928; Bucknill, 1928), and later regarded as uncommon (Beu, 1967; Powell, 1979), but is now known to be locally abundant (Beu, 1977). This was because the habitat of this species is rarely examined for chitons, so its true abundance was not realised until long after its initial discovery. The habit of living on rock, pebbles and shells in sand, often on fragments smaller than the size of the animal, and sometimes freelifing in sand, is considered very rare among the Polyplacophora, but as this habitat is rarely examined for chitons, it may contain more species than is currently realised.

P. cuneata resembles members of the southern Australian genus *Bassethullia*, in both appearance and habitat, although the differences are sufficient to warrant separation at the generic level (see remarks under *Pseudotonicia*). The habitat of *P. cuneata* is very similar to that of the members of *Bassethullia* (see Gowlett-Holmes, 1990), so the similarities between the two groups may be attributable to convergent evolution towards a similar habitat rather than common ancestry.

Boreham (1959) selected a lectotype (NZGS TM1234), an incomplete specimen, and a paralectotype (NZGS TM1235), three disarticulated valves, for this species from Suter's (1908) original material. However, after examining this type material, it was found that the three valves are from the incomplete specimen. As a single specimen cannot be split into a lectotype and a paralectotype, the material actually represents only a lectotype, and the two previous lots are now combined in one lot (NZGS TM1234).

A seven-valved specimen of *P. cuneata* (SAM D18605) was collected at Mount Maunganui, North Island, in Sept. 1988 by the author and Mr N. Holmes. This specimen shows no abnormality other than the lack of a median valve, so the missing valve is probably a genetic fault.

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